MONITORING PLAN

PROJECT NO. ME-13
FRESHWATER BAYOU CANAL BANK STABILIZATION

ORIGINAL DATE: February 10, 1997
REVISED DATE: July 23, 1998

Preface

Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reduced in scope due to budgetary constraints. Specifically, post-construction aerial photography was reduced from three flights to one flight.

Project Description

The Freshwater Bayou Canal Bank Stabilization (State project no. ME-13, CWPPRA project no. XME-29) project area encompasses 1,169 ac (468 ha) of intermediate and brackish marsh along the west bank of Freshwater Bayou Canal (FBC) between its confluence with North Prong Belle Ile Bayou Canal and Sixmile Canal in Vermilion Parish, Louisiana (figure 1). The project area extends westward from FBC for 0.25–1.0 mi (0.4 - 1.6 km) to several north-south oilfield access canals, which form an almost continuous, north-south line of spoil banks parallel to FBC.

The ME-13 project area, which is included within the larger Freshwater Bayou Wetlands Hydrologic Restoration (ME-04) project area, is adversely affected from the west by the influence of prolonged periods of elevated water levels from the Grand/White Lake system, and from the east by tidal scour and saltwater intrusion associated with erosion of the spoil banks along the west bank of FBC. The former problem is being addressed by the Freshwater Bayou Wetlands Hydrologic Restoration (ME-04) project. The latter problem is the main cause of wetland loss in the ME-13 project area, where most of the west spoil bank along this section of FBC has already eroded away, exposing fragile organic marsh soils along the bank to boat-wake induced shoreline erosion, tidal scour, and the impact of salinity spikes entering FBC, mainly from Vermilion Bay. The project at hand is designed to minimize the loss of wetlands from bank erosion and the subsequent deterioration of adjacent marshes along the canal.

Constructed between 1965 and 1967, the FBC channel extends from the Gulf Intracoastal Waterway (GIWW) at Intracoastal City to the Gulf of Mexico and includes a lock at the Gulf of Mexico to reduce saltwater intrusion into the fresh water and low salinity interior wetlands along the canal. Approximately 300,000 tons of cargo were transported along FBC between 1979 and 1986 (U. S. Army Corps of Engineers [USACE] 1989), mostly in oil and gas service and supply vessels, and commercial fishing boats. Based on data provided in a feasibility report by Brown and Root (1992), an average of 34,051 large vessels (crew boats, jack-up barges, supply boats, and commercial fishing boats) traveled through the FBC lock and channel each year between 1968 and 1992.

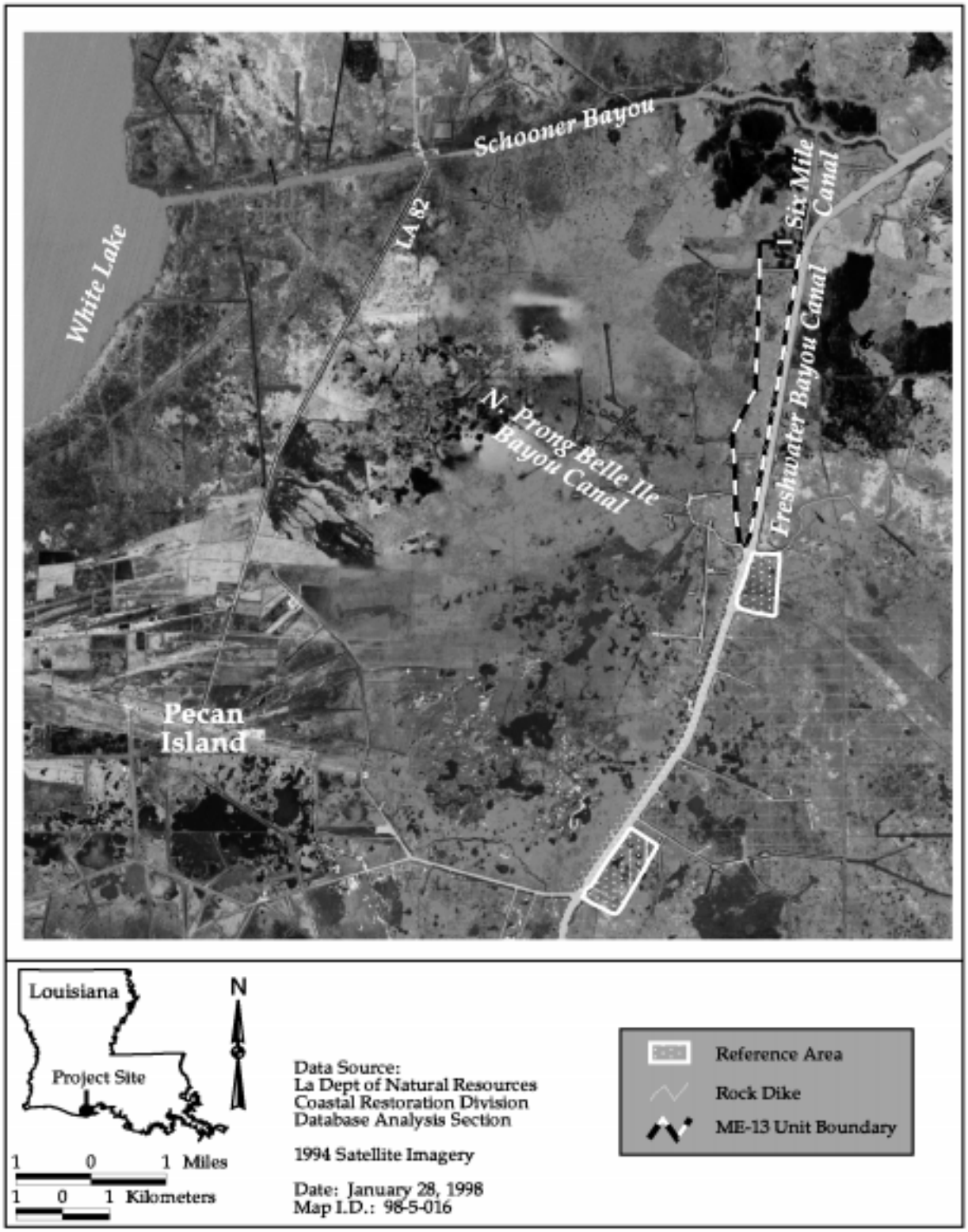

Figure 1. Freshwater Bayou Canal Bank Stabilization (ME-13) project area map showing project and reference area boundaries and rock dike location.

Construction of canals and navigation channels results in immediate and cumulative impacts to wetlands. Turner and Cahoon (1987) estimated that 1,423 ac (569 ha) of wetlands were lost through construction alone (i.e., channel excavation and spoil bank construction) of the FBC channel to its original depth of 12 ft (3.7 m) and bottom width of 125 ft (38 m). Over time, wave erosion of the banks along FBC by wakes from the large, deep-draft vessels that use this channel has resulted in breaching of the shoreline spoil banks in numerous places, followed by tidal scour of the upper layers of the highly erodible soils of the adjacent marsh, and conversion of emergent marsh to shallow, open water areas. This process has been exacerbated by the impact of saltwater on the salt-intolerant vegetation growing along the canal near spoil bank breaches. Although the lock at the south end of FBC prevents saltwater from entering the canal from the Gulf of Mexico, saltwater still enters the canal from the north end, via Vermilion Bay. As salt-intolerant plant species become stressed and die, the soil-binding effect of their root systems is lost, allowing tides to further disperse the soil particles. Since the organic marsh soils behind the spoil banks are more erodible than the spoil banks, erosion rates can be expected to double or triple along shorelines where the spoil banks are no longer present (USACE-LDNR 1994; Good et al. 1995). As shoreline marshes convert to open water, canals continue to widen. The average bank width of the original FBC channel was 173 ft (53 m). By 1990, the average bank width of the channel had more than tripled to 583 ft (178 m) (Good et al. 1995). Brown and Root (1992) estimated that between 1968 and 1992, shoreline erosion along FBC averaged 12.5 ft/yr (3.8 m/yr) on each bank. Data collected at reference sites on the east bank of the canal opposite from the ME-04 rock dike termini points indicate that between April 1995 and July 1996, the east bank of the canal eroded at an average rate of 6.54 ft/yr (2.0 m/yr) (LDNR 1996).

This process of canal widening and subsequent degradation of adjacent wetlands is widespread, and it is a major contributor to wetland loss in coastal Louisiana (Good et al. 1995). Canal widening due to boat wake-induced wave erosion of the banks at rates of 14.7 to 19.6 ft/yr (4.5 to 6.0 m/yr) was documented nearly 40 years ago (Nichols 1958) in the Mermentau River Basin along sections of Superior Canal that traverse wetlands with highly erodible, organic marsh soils similar to those along FBC. In his review of the construction and maintenance aspects of the report on the proposed FBC channel prepared by the U.S. Army Corps of Engineers (1958), Bovay (1959) expressed concern that bank erosion at rates up to 7 ft/yr (2.1 m/yr) could be expected along FBC.

To prevent further wetland loss through bank erosion and subsequent tidal scour of shoreline marshes, approximately 23,193 linear ft (7,069 m) of free-standing rock dike will be constructed in shallow water along the west bank of FBC between its confluence with Sixmile Canal on its north end and North Prong Belle Ile Bayou Canal on its south end (figure 1).

Two similar rock dike projects have already been constructed along FBC. The FBC Bank Protection (T/V-11) project, completed in May 1994, is now protecting wetlands along the east side of the canal opposite from the project proposed herein. Wetlands along the west side of the canal south of the ME-13 project area are now protected by the Freshwater Bayou Wetlands (ME-04) project rock dike, completed in January 1995.

Project Objectives

1. Protect the existing emergent wetlands along the west bank of FBC and prevent their further deterioration from shoreline erosion and tidal scour.

2. Prevent the widening of the FBC channel into the project area wetlands.

Specific Goal

The following goal will contribute to the evaluation of the above objectives:

1. Decrease the rate of shoreline erosion along the west bank of FBC using a rock dike.

Reference Area

In order to evaluate project effectiveness over time, a reference area will be monitored concurrently with the shoreline protected by the dike. Data collected will be used to make statistically valid comparisons of the shoreline erosion rate with and without the project. The main criteria for selecting a reference area are similarities in vegetative community, soil type, and hydrology. Another very important criterion in this case is the amount and type of boat traffic on the channel.

The only sites in the project area that could be reasonably considered were along the GIWW, Schooner Bayou (old GIWW), and FBC. Sites along the GIWW and Schooner Bayou were eliminated on the basis of differences in soil type and boat traffic. The vegetative community and the shoreline soils along the FBC are more similar to each other than to the soils along the GIWW and Schooner Bayou. There is also much more crew boat traffic on FBC.

The reference areas selected are the same ones being used to monitor the ME-04 rock dike, i.e., two 0.5 mi segments of shoreline located along the east bank of FBC, one opposite the south end and one opposite the north end of the ME-04 rock dike. The vegetation in these reference areas is similar to the project area, and like the project area shoreline, each of the reference areas includes both intact and deteriorated sections of spoil bank. The close proximity of these project and reference areas also makes it very practical to use the two ME-04 reference areas for monitoring the ME-13 rock dike.

The soil type in both reference areas is a Banker muck, while most of the project area soil is Clovelly mucky clay, with only the southernmost section classified as Banker muck (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA/NRCS] 1996). The main difference between these two organic marsh soils is that Clovelly soils typically have an upper muck layer 0-36 inches thick, which makes them more susceptible to tidal scour and erosion than Banker soils, which have an upper muck layer only 0–6 inches thick. The amount of boat traffic can be expected to be the same for the project area and both reference segments. Thus, data collected can be used to

compare erosion rates between the project area and reference area, as well as between the two reference areas.

Changes in shoreline position and land to open water ratios will be evaluated in both the project and reference areas. Aerial photography will be flown for both the project and reference areas to provide a database for documenting changes in land to open water ratio. Shoreline changes will be documented by direct measurement at 1,000-ft (305 m) intervals in the project area for comparison with data from similarly dispersed stations in the two reference areas.

Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goal listed above:

1. Aerial Photography — To document shoreline position, and land and water areas along FBC in both the project and reference areas, near-vertical, color-infrared aerial photography (1:12,000 scale in the project area, 1:24,000 in the reference area, with ground controls) will be obtained in 1996 (pre-construction) and in 2015 post-construction. The photography will be georectified by National Wetlands Research Center (NWRC) personnel using standard operating procedures described in Steyer et al. (1995). Detailed photointerpretation, mapping, and Geographic Information System (GIS) interpretations are not currently planned on the ME-13 aerial photography.

2. Shoreline Change — To document changes in shoreline position along FBC, the distance from each of the 24 settlement plates installed at 1,000 ft (305 m) intervals along the dike to the adjacent vegetated marsh edge will be determined by direct measurement using a steel tape. The X-Y coordinates for each settlement plate and the vegetated marsh edge of the adjacent shoreline will be determined using a differential Global Positioning System (GPS) unit. The GPS coordinates will be used to relocate the vegetated marsh edge of the shoreline adjacent to each settlement plate over time, and to calculate the distance between each pair of points. Additional GPS readings will be taken on a survey monument at the north end of the ME-04 rock dike at the beginning and end of each day. Differential GPS readings taken will be used as an accuracy check on our instrument and for determining error associated with the GPS readings. For comparison, the distance from six survey monuments to the vegetated marsh edge of the adjacent shoreline in the two reference areas on FBC opposite the ME-04 rock dike will be similarly monitored concurrently. Changes in distance from the settlement plates and survey monuments to the adjacent

shorelines will be averaged to estimate shoreline erosion rates over time. The direct measurements will serve as a check on the accuracy of distances calculated between points using differential GPS. Shoreline position relative to the 24 settlement plates and six reference area survey hubs will be documented at the same time of the year, once in 1998, and in post-construction years 2003, 2009, and 2015.

Anticipated Statistical Analyses and Hypotheses

The following hypotheses correspond with the monitoring elements and will be used to evaluate the accomplishment of the project goal.

1, 2. Shoreline Change. Descriptive and summary statistics, analysis of variance (ANOVA), and suitable hypothesis testing will be used to compare measured rates (in ft/yr) of shoreline movement along FBC adjacent to the project and reference areas between successive years. In addition, GIS interpretations of the pre- and postconstruction aerial photography taken on the Freshwater Bayou Wetlands (ME-04) project, and of historical data sets available in digitized format for 1956, 1978, 1988, and any subsequent years that become available, will be used for statistical analysis of the long-term movement of the project area shoreline along FBC. When the H_0 is not rejected, the possibility of negative effects will be examined. Two sets of hypotheses will be tested to determine if the following project goal has been met.

Goal: Decrease the shoreline retreat rate along 23,193 ft (7,069 m) of the west bank of FBC adjacent to the project area.

Hypothesis:

H_0: The shoreline retreat rate along the project area at time point i will not be significantly less than the shoreline retreat rate along the reference area at time point i, where i = years 1998, 2003, 2009, and 2015.

H_a: The shoreline retreat rate along the project area at time point i will be significantly less than the shoreline retreat rate along the reference area at time point i, where i = years 1998, 2003, 2009, and 2015.

Hypothesis:

H_0: Shoreline retreat rate along the project area at time point i will not be significantly less than the shoreline retreat rate along the project area in previous years.

H_a: Shoreline retreat rate along the project area at time point i will be significantly less than the shoreline retreat rate along the project area in previous years.

Notes

1.	Implementation:	Start Construction:	March 1, 1998
		End Construction:	June 1, 1998
2.	NRCS Point of Contact:	Joseph Conti	(318) 473-7687
	NRCS Monitoring Manager:	Marty Floyd	(318) 473-7690
3.	Vermilion Corp. Contact:	W. P. "Judge" Edwards	(318) 893-0268
4.	DNR Project Manager:	Mel Guidry	(318) 893-7947
	DNR Monitoring Manager:	Karl A. Vincent	(318) 893-2246
	DNR DAS Assistant:	Mary Horton	(504) 342-4122

5. The twenty year monitoring plan development and implementation budget for this project is $56,748. A progress report will be available in June 1999, and comprehensive reports will be available in June 2004, June 2010 and June 2018. These reports will describe the status and effectiveness of the project.

6. References:

Bovay , H. E., Jr. 1959. Review of estimates of construction and maintenance costs as shown in (the) report on "Survey of Freshwater Bayou and vicinity, Louisiana," by the U.S. Army Corps of Engineers. Engineering section in L. M. McBride and E. McIlhenny, comps., Survey and Report of Vermilion Corporation in Opposition to Project. Chicago, Ill.: Twentieth Century Press.

Brown & Root, Inc. 1992. Conceptual engineering report for Freshwater Bayou Canal bank stabilization, Vermilion Parish, Louisiana. Prepared for Department of Natural Resources/Coastal Restoration Division. Belle Chase, La.: Brown and Root, Inc. 26 pp.

Good, B., J. Buchtel, D. Meffert, J. Radford, K. Rhinehart, and R. Wilson 1995. Louisiana's Major Coastal Navigation Channels. Unpublished report. Baton Rouge: Louisiana Department of Natural Resources, Office of Coastal Management and Restoration. 57 pp.

Louisiana Department of Natural Resources 1995. Monitoring plan. Project No. ME-04: Freshwater Bayou Wetlands (Phase 1). Unpublished report. Baton Rouge: Coastal Restoration Division. 10 pp.

—— 1996. Shoreline erosion rates at monitoring sites along the west bank of Freshwater Bayou Canal behind the Freshwater Bayou Wetlands (ME-04) project rock dike and along two reference areas on the opposite bank, for 1995-1996. Abbeville, La.: Coastal Restoration Division, Biological Monitoring Section. Unpublished data.

Nichols, L. G. 1958. Superior Canal System, Rockefeller Wild Life Refuge and Game Preserve. New Orleans: Louisiana Wildlife and Fisheries Commission, Refuge Division. 000 pp.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson 1995. Quality management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring plan. Open-file series 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 108 pp., plus 3 appendices.

Turner, R. E., and D. R. Cahoon, eds. 1987. Causes of Wetland Loss in the Coastal Central Gulf of Mexico. Volume II: Technical Narrative. Final report submitted to Minerals Management Service. Contract No. 14–12–0001–30252, OCS Study/MMS 87–0120. New Orleans, La.: Minerals Management Service. 125 pp.

U. S. Army Corps of Engineers 1958. Survey of Fresh Water Bayou and vicinity, Louisiana. New Orleans, La.: USACE, Board of Engineers for Rivers and Harbors.

—— 1989. Water Resources Development in Louisiana - 1989. Vicksburg, Miss.: U.S. Department of the Army, Lower Mississippi River Valley Division, Corps of Engineers.

U. S. Army Corps of Engineers and Louisiana Department of Natural Resources 1994. Freshwater Bayou Canal Bank Stabilization (XME-29). Candidate Project Information Sheet for Wetland Value Assessment. Unpublished report. Baton Rouge: Coastal Restoration Division. 16 pp.

U. S. Department of Agriculture, Natural Resources Conservation Service 1996. Soil survey of Vermilion Parish, Louisiana. Publication No. 1996–405–693/20014/SCS. Washington, D.C.: U.S. Government Printing Office. 183 pp, 98 maps. Scale 1:20,000.